

A.2.2 Regional specific analysis

General Data		
Country	Italy	
Province	Aosta	
Name of AlpHouse Region	Valle d’Aosta	
Area	3.263,25	km <sup>2</sup>
Population	127.065	i
Central town	Aosta	

**Description of the region and its location**

The Valle d’Aosta forms a distinct geographic region with respect to the surrounding zones, constituting a “region” not only from an administrative point of view but also from a geographic point of view. It is defined as “intramontana” (in mountains) because of its particular position which makes it appear like an island surrounded by the Graie and Pennine Alps in the western section of the alpine chain and in particular by the higher European peaks: Monte Bianco, Cervino, Monte Rosa and Gran Paradiso. Its strategic position at the frontier of the Alps has determined its development: the region, in fact, has assumed a quite important role as a crossroads between the north and south of western Europe.

The Valle d’Aosta is an autonomous region, as established in the “Statuto speciale” of the 1948 that defines the primary power of the region on many subjects. Moreover the “Statuto speciale” defines the bilingualism, in which the use of the Italian language is equal to the use of the French language. The region preserves important evidence of the past, with significant ruins of the Roman presence and with numerous medieval castles.

[http://www.regione.vda.it/statistica/pubblicazioni/pdf/relazione\\_2010.pdf](http://www.regione.vda.it/statistica/pubblicazioni/pdf/relazione_2010.pdf), oo. 13-15

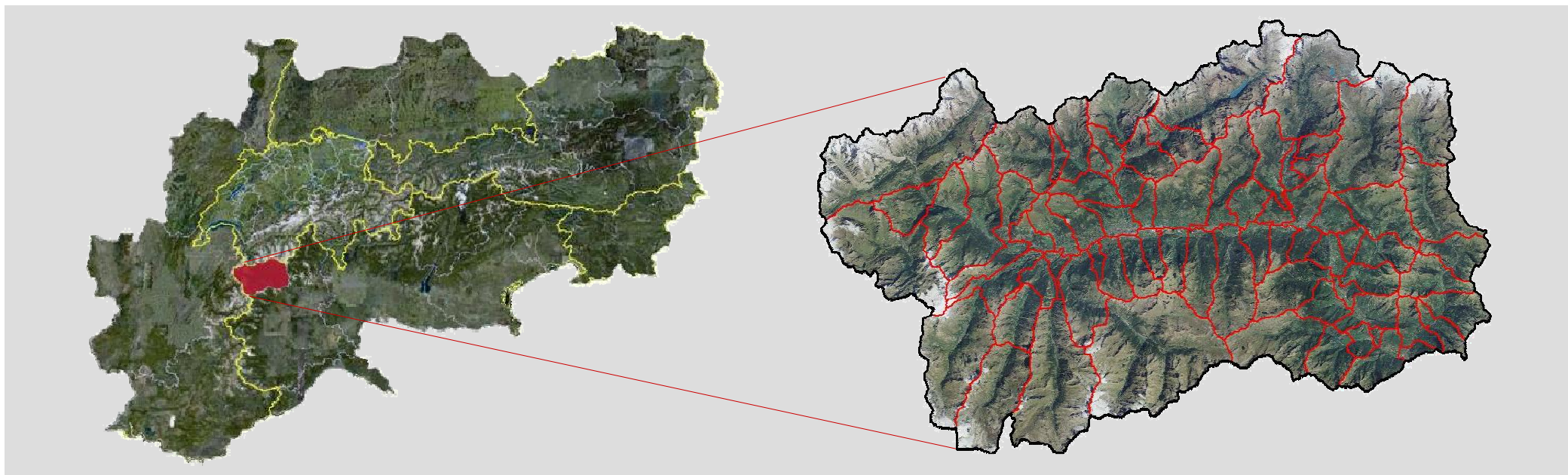


Figure 01 – Location of the region  
source: Alphouse Elaboration of Google Earth and Alpine space maps

A.2.2 Regional specific analysis

**Selection criteria**

The regional part of the analysis includes the whole Aosta Valley region. The small size of the region allows it to conduct a significant analysis of the whole territory; it is, in fact, of primary importance to consider the region in its entirety to understand all the main aspects characterising its history and its development.

In this way it's possible to carry out an analysis of geographical, climatic, economic and typological regional aspects. Moreover, the comprehensive analysis allows to:

- consider the richness of the architectural heritage and the common problems bound to its degradation, its conservation and its energy renovation;
- analyse in all the Municipalities the level of integration of the energy concepts in the planning tools;
- investigate the best practices in the energy field applied on the territory,
- involve all the Municipalities sharing the steps of the activities and the results of the AlpBC project, giving a support to the local administrators.





A.2.2 Regional specific analysis

**A.2.2.1 - Natural landscape**

The course of the Dora Baltea constitutes the main axis of the region. Orographically, on the left and the right of the Dora, 13 valleys and numerous *vallons* (glens) unfold, from which numerous water courses run down to the river. The central valley, in the part between the Municipalities of Saint-Vincent and Villeneuve, is oriented south-north. For this reason there is a shady side called the “*envers*”, located on the orographic right of the Dora Baltea and characterised by spruce and larch woods, and a sunny side, called “*adret*”, located on the orographic left of the river, which is arid and characterised by oak and pine woods, cultivated with vineyards. The “*adret*” and the “*envers*” are different for climate, vegetation, shape and number of settlements. Moreover the Aosta Valley territory presents some distinctive and peculiar characteristics that determine two sub-regions: the “*Plaine*” and the “*Montagne*”.

The “*Plaine*” (Plain) is the flat land constituted by the flood plains of the Dora Baltea and the “*Montagne*” (Mountain) is formed by the mountainsides and the lateral valleys. The “*Montagne*” occupies 96,3% of the Valle d’Aosta territory and only 7% is suitable for intensive agriculture and permanent settlements. The “*Plaine*” is the portion of land with the most settlements, characterised by vast flood plains that constitute excellent agricultural land. The surface area of the region just exceeds 320,000 hectares and the average altitude above sea level is 2106 m. 40% of the region is situated above the upper limit for vegetation. Pastures and woods cover circa half of the regional territory: humans can live in these environments only in the warmer months moving towards the higher pastures for livestock rearing and use of the resources from the woods. The portion of territory habitable all year round, which is suitable for intensive agriculture, has a surface area of circa 285 km<sup>2</sup> (8.7% of the total surface area of the region).

In the Aosta Valley there are 200 glaciers, for a total surface area of 120 km<sup>2</sup>. Their meltwater produces 5 million m<sup>3</sup> of water every year and is one of the greatest water stocks in Italy. The Aosta Valley is the European region with the highest number of protected areas. 13% of the regional surface is occupied by parks, natural reserves and oases.

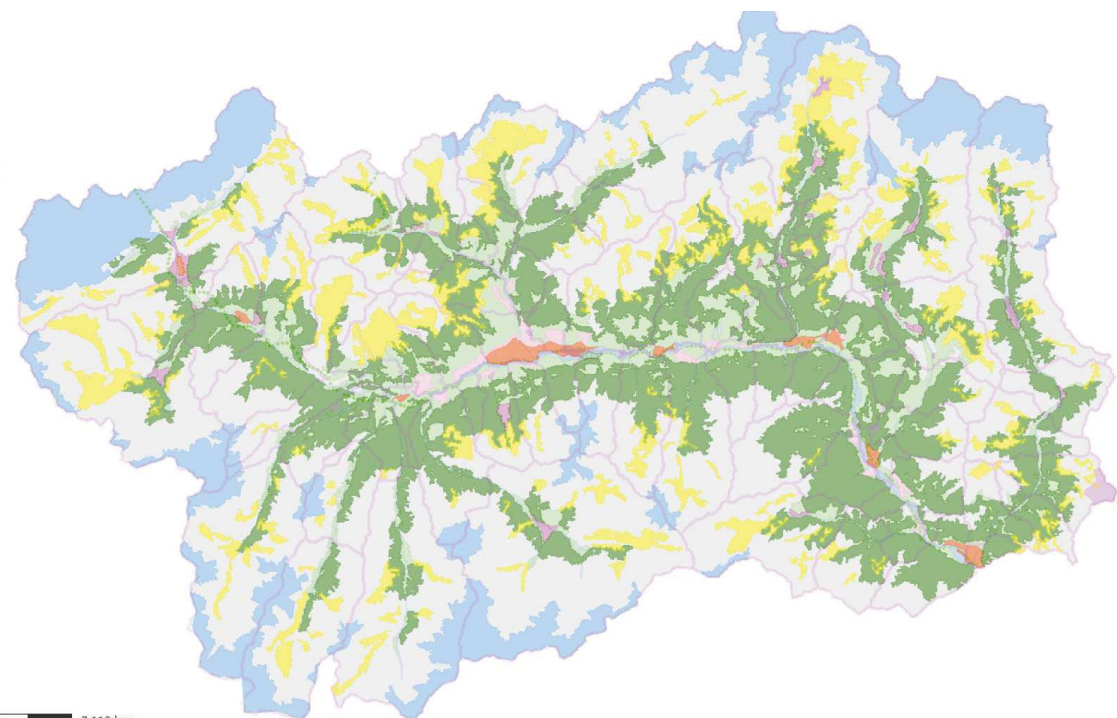


Figure 02 – Overview map of the land use and settlement location  
 source: Alphouse Elaboration of the regional Geoportale - <http://prod-sitr.partout.it/geocartosct/index.html>

A.2.2 Regional specific analysis

A.2.2.2 - Settlements

The two sub-regions “Plaine” and “Montagne”, the sides “adret” and “envers”, as well as important frontier communication routes, a great variety of climates and an uneven distribution of resources have determined the kind of aggregation of buildings that have developed (linear, concentrated, sparse). Notwithstanding the fact that new infrastructure networks and the expansion of settlements have modified the landscape and the ancient settlements, it is still possible to perceive the original layout, presumably medieval. Agriculture and livestock rearing have been the predominant activities for many years in Valle d’Aosta. These activities have strongly influenced the structuring of the agricultural landscape of the Valle d’Aosta. To understand the distribution of the settlements across the territory it is essential to be aware of the structuring of the landscape according to the altitude bands.

The *valley floor* is generally rich in infrastructure, with a strong presence of humans and their activities; the settlements are consistent in size and the crops are characterised by arable crops, vineyards, orchards.

From the “*adret*” slope, from 500 to 1000 metres of altitude the “*collina*”(hill) can be identified, which is similar to the valley floor with regards to agricultural crops, but less infrastructure is present; the villages are of reasonable size and they are inhabited permanently all year.

The “*media montagna*”(mid mountain), from 1000 to 1600 metres of altitude, has a lower temperature and therefore the orchards and vineyards give greater space to arable crops, meadows and woods. The villages are smaller in size, more diffused across the landscape and are generally inhabited on a seasonal basis.

The “*montagna*”(mountain), from 1600 to 2500 metres of altitude, still presents an occasional seasonal village and alpine pastures; this zone is characterised by ample meadows and woods.

The “*envers*” slope, characterised by a poorer solar radiation, presents very ample wooded bands, meadows and pastures. The villages are large in size on the valley floor, while at higher altitudes there are smaller settlements called “*mayen*”.

As well as the characteristics of the altitude bands other factors have also played a fundamental role in the distribution of settlements across the territory: good exposition, protection from avalanches and dominant winds, presence of water.

Another settlement factor in some cases was the proximity to an important communications network.

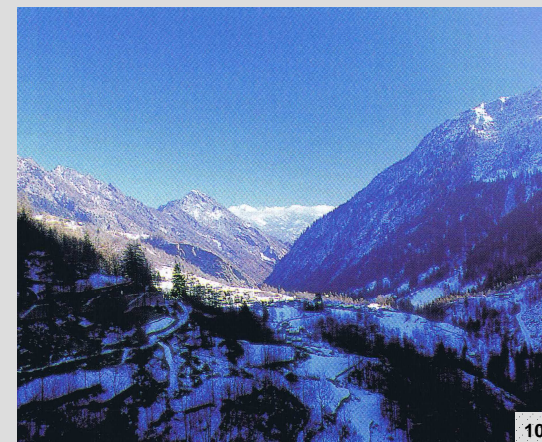
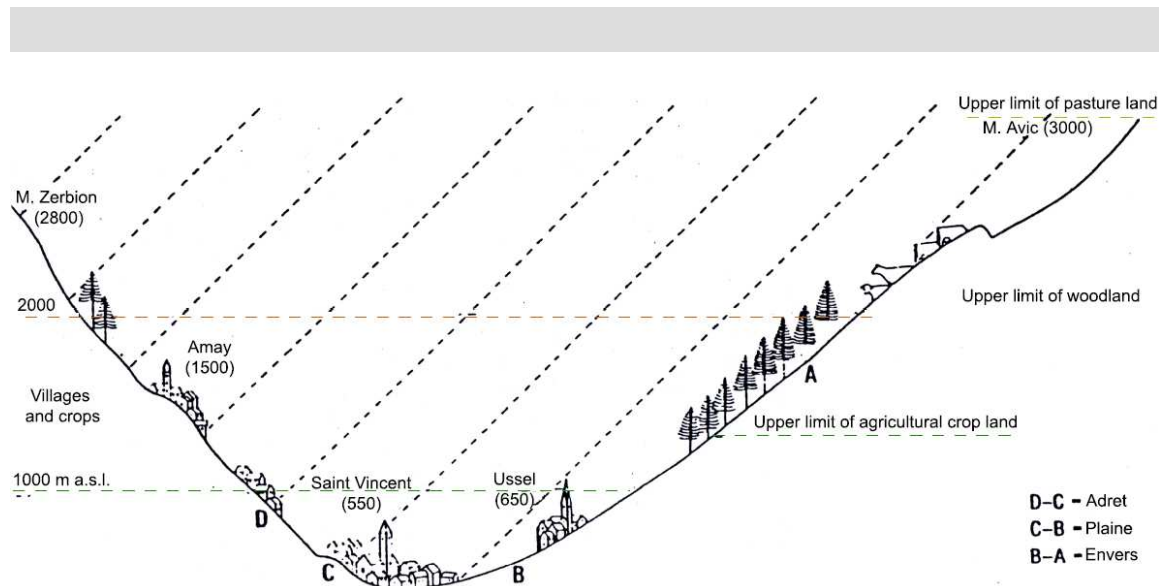


Figure 03 – Diagram - section of the central valley highlighting human settlements and crops according to the different exposition of the mountain slopes  
source: Althouse elaboration of the diagram in CERUTTI 1995, p. 21



A.2.2 Regional specific analysis

A.2.2.2 - Settlements

The size of the villages have always been proportional to the surrounding agricultural land, that is to the portions of cultivated land situated near the settlement. Within this territory divided into altitude bands, the population, tied to agriculture and livestock rearing, moved according to the seasons of the year, thus exploiting land productivity in the best possible way.

For the settlements it is possible to use the following classification, based on the complexity and the nature of the historical processes of structuring:

- The **historical centre** of Aosta: founded in 25 B.C. presents characteristics of a Roman town, with parallel and perpendicular axes to the level curves and with rectangular “*insulae*”(blocks).
- The **“bourgs”**: are fortified settlements or those with a very compact and planned layout, built along the main axis in relation to an important historical layout.
- The **“villes”**: constituted settlements where the population was concentrated already from medieval times; characterised by a compact particle layout and relatively ordered, these were usually in a higher position on flat land and near a water course with respect to the valley floor.
- The **“villages”**: are secondary settlements of population concentration and are considered in this category if they have at least twelve buildings; usually these settlements do not have an ordered layout.
- The **“hameaux”**: are settlements quite small in size that have less than twelve buildings in a scattered or compact layout.

Other settlements of more recent construction.

Today for some settlements the isolation due to the scarcity of communication networks has led to a progressive abandonment and to a rapid degradation of the buildings. The, often radical, modification of lifestyle has brought a transfer of work activities to the main municipalities of the valley floor or in the municipalities with greater tourist attraction thus creating an abandonment of livestock rearing and agriculture thus upset-

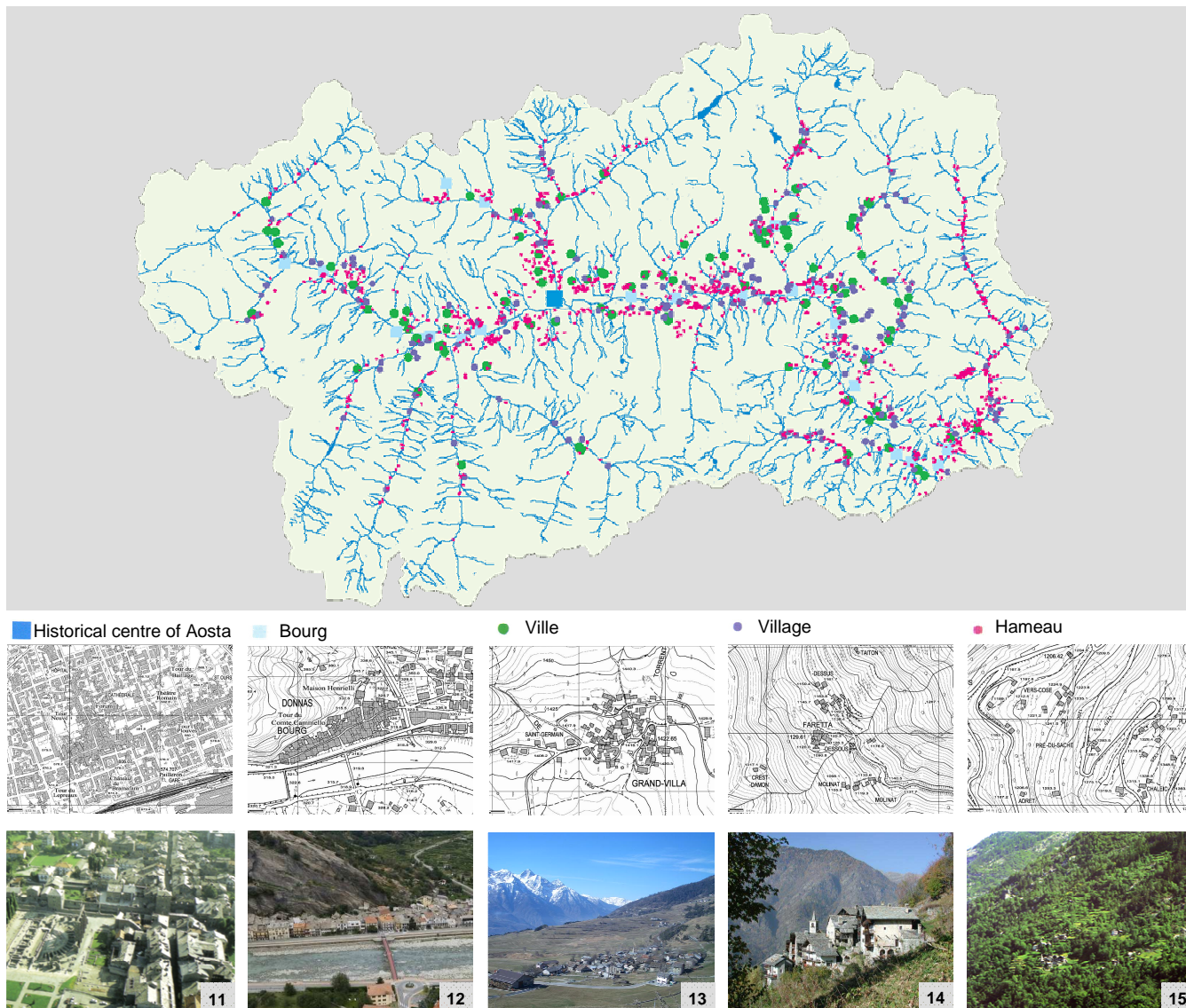


Figure 04 – Overview map of the historical settlements in the region

source: PTP - Relazione illustrative, p.163; Althouse Elaboration of the regional Geoportale - <http://prod-sitr.partout.it/geocartosct/index.html>

## A.2.2 Regional specific analysis

**A.2.2.3 - Population and households**

On an area of just over 3.200 km<sup>2</sup> a population of approximately 128.000 (percentage of females is equal to 50,9%), corresponding to a density of 39 residents/km<sup>2</sup>.

Since the mid 80s, the population living in the Aosta Valley has been growing. The population is distributed over 74 municipalities, of which only one (Aosta) has more than 10.000 inhabitants. All the other towns have populations of less than 5.000 residents and only in two cases (Saint-Vincent and Châtillon) this number is barely reached. At a greater level of detail, we note that 17 communities have a number of residents between 2.000 and 5.000 people (23%), while less than 43 (58%) show a number of less than 1.000 residents. The remaining 13 municipalities have a population between 1.000 and 2.000 residents. About 76% of the population is concentrated in the central valley where 30 municipalities make up the Central Valley which is not mountainous, while the remaining population is distributed in the remaining municipalities at medium and high altitude. Furthermore, half of the regional population is concentrated in eight municipalities with a population equal to or greater than 3.000 residents.

Despite the region as a whole has a low population density, some municipalities show a population density higher than the

Population - Year 2008 <sup>(A)</sup>		
Age	i	%
0-9	12.017	9,46
10-19	10.750	8,46
20-29	12.612	9,93
30-39	19.765	15,55
40-49	21.030	16,55
50-59	16.879	13,28
60-69	15.077	11,87
70-79	11.697	9,20
80-	7.238	5,70
<b>Total</b>	<b>127.065</b>	<b>100</b>

**A.2.2.4 - Economy**

The data up until 2010 confirm that the most consistent quota of regional added value comes from the service sector (74,8%), 24% stems from industry and the remaining quota comes from the primary sector.

More than 60% of agricultural production stems from animal husbandry and from the food production connected to it; agricultural crops count for 14% of the sector, while the remaining quota depends on service activities connected to agricultural production. In the secondary sector the building sector has a great influence which contributes circa 44% to the formation of the industrial added value. Furthermore, the quota of regional product that derives from the secondary sector appears significantly less than the average Italian data and above all of that area of the North-west (31,3%).

The manufacturing industry appears to be in a fragile position, both for the dependence of many companies on orders from outside the Valle d'Aosta, as well as the overall size of the companies. In the Valle d'Aosta the incidence of the service sector (74,8%) is somewhat relevant.

Within the service sector, a significant role is occupied by tourist and commercial activities, that overall count a quarter of the regional product and contributes to circa 30% of the added value of the tertiary sec-

Sector	Regional code	Regional relevance [1-5]	Number of enterprises	Statistic numbers <sup>1</sup>
Primary		1		4,72 %
Forestry/ agriculture/farming/hunting/fishing	A-B		2.037	
Mining	C		12	
Secondary		4		36,22 % (building sector 22,05%)
Building sector	F		2.823	
Manufactory	D		1.045	
Production and distribution of energy	E		30	
Tertiary		5		59,06 % (trade 11,02%)
Tourism	H		1.499	
Bank/financial/real estate/other business	J-K		1495	
Trade/communication	G		2.385	
Transports	I		292	
Sanitary/public and social services/education	M-N-O		716	
Other services	NC		114	



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A.2.2.5 - Climate

The lack of homogeneity of the territory brings particular microclimatic conditions due to altitude, to the exposition of the slopes, to the different wind and humidity conditions. The climate of the region is continental, even if the seasonal distribution of precipitation is not that which is characteristic of central European continental climates, having a principal maximum in autumn and a secondary in spring, while the minimum is in winter. The annual precipitation is scarce because the high mountains that surround the region form a barrier to the perturbations coming from the west. In particular the central part of the valley has a notably arid climate. The average annual precipitation for the region is 950mm. The average annual temperature is around 10-12 °C in the valley floor and descends to circa 7,5 °C at 1200 metres above sea level, while between 2000 and 2500 metres above sea level the temperature is between 3 and -2 °C; above 3100 metres (permanent glacier) the temperature is almost constantly below 0 °C. The majority of the region is affected by the phenomenon of *föhn*, caused by the perturbations coming from North-Western Europe, that generate a rapid increase in temperature and a decrease in the air humidity on the valley floor. For this reason it is possible that some winter days can reach a maximum temperature above 20°C in the central valley with minimum temperatures above 0 °C even at elevated altitude. Solar radiation is not distributed evenly in the Region; in determinate locations the sun does not rise above the mountain horizon above them and is absent for whole seasons. On the *“adret”* the sun’s rays fall in an almost perpendicular manner to the ground, with a very concentrated level of energy; thus the land on this slope are characterised by high temperatures, snow melts quickly and evaporation from the ground is intense. On the slopes of the *“envers”* however the sun’s rays form a more acute angle with the ground, losing heat; thus the temperatures on this slope are 4 or 5 degrees lower than those of the *“adret”*. Appendix A to the Dpr 412 of 1993 divides Italian municipalities on the basis of degree days, all the municipalities in the Valle d’Aosta fall into 2 climate bands (E, F) that is:

- Band E: municipalities that present a degree day index above 2,100 but not above 3,000;
- Band F: municipalities that present a degree day index above 3,000.

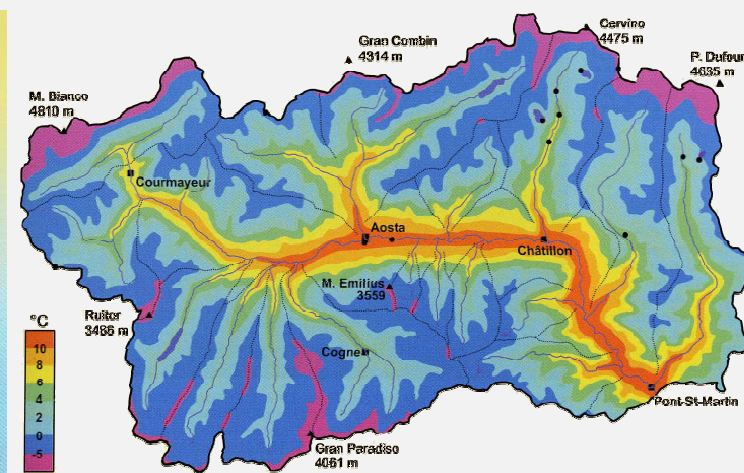
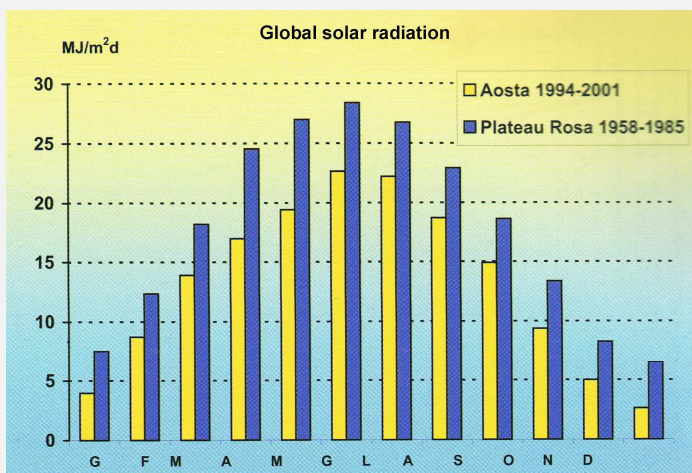
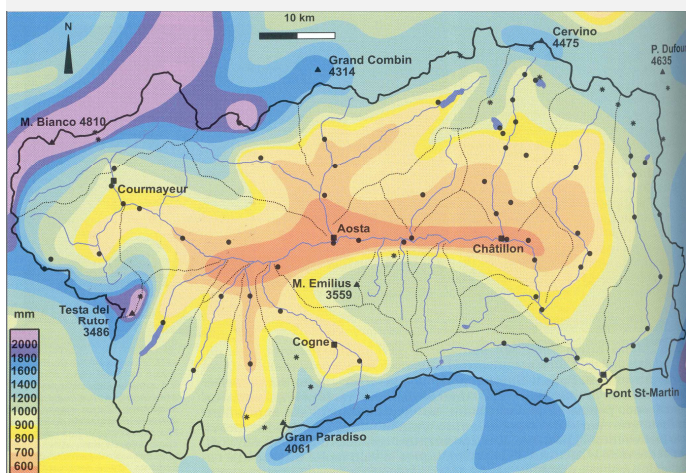


Figure 05 – Climate data - VDA Isohyet Map  
[rain and melted snow mm - average years 1920-2000]  
Source: MERCALLI 2003, p. 186

Table 01 – Climate data - VDA Global solar radiation  
[global solar monthly radiation in Aosta and Plateau Rosa]  
Source: MERCALLI 2003, p. 181

Figure 06 – Climate data - VDA Isotherm Map  
[average years 1950-2002]  
Source: MERCALLI 2003, p.131

A.2.2 Regional specific analysis

A.2.2.7 - Energy

On the basis of the studies undertaken for the development of the Regional Energy balances 2001-2006, the analysis of consumption per sector shows how the energy requirements of the region are constantly growing, especially in the sectors of transport and civil use, which together account for circa 80% of regional energy requirements. The transport sector contributes notably to the overall regional energy balances. The sector is difficult to regulate in a border region as the Valle d'Aosta characterised by transit traffic and by traffic flows bound to tourism in the territory and for this motive, in this context, a specific study will be undertaken. Thus the consumption currently considered refer to stationary chains, excluding the "transport" sector.

Analysing consumption of the various energy vectors (type of source) it is clear that the greatest percentage is covered by fossil fuels, the consumption of which has increased in recent years.

Liquid fuels constitute more than 40% of energy consumption while gas fuels (natural gas) covers circa 27%. Consumption of natural gas has registered an important increase between 1990 and 2006 due to its wide use in the civil sector. More marginal, almost nonexistent, is the contribution from of solid fuels and of other renewable sources, including biomass and solar thermal, which differ from electricity production from renewable sources (hydroelectric, biogas, photovoltaic). With sole reference to the stationary energy chains the civil sector has high energy demands as in the period from 2001-2006 it was responsible for slightly more than 65% of fossil fuel consumption.

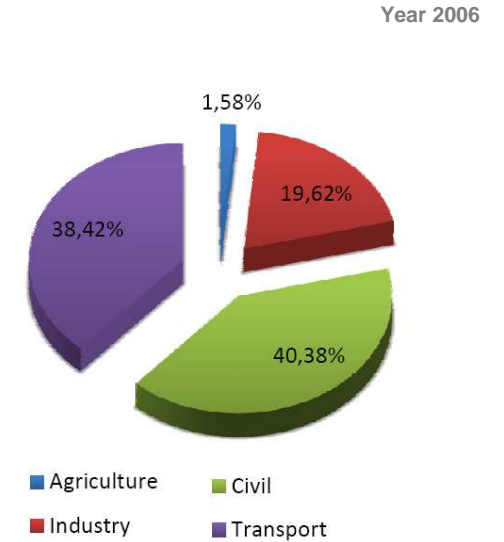
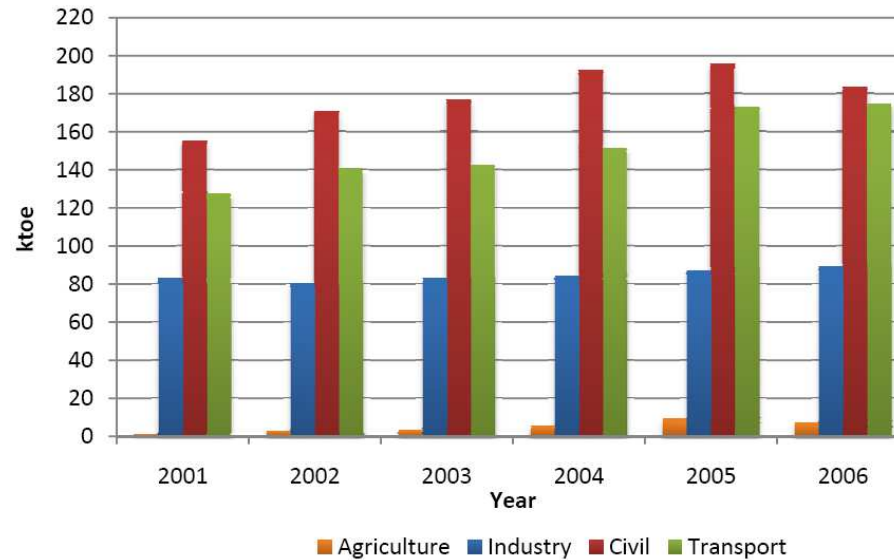


Table 05 – Usage of energy carriers for sector in the region  
Source: BER 2001-2006

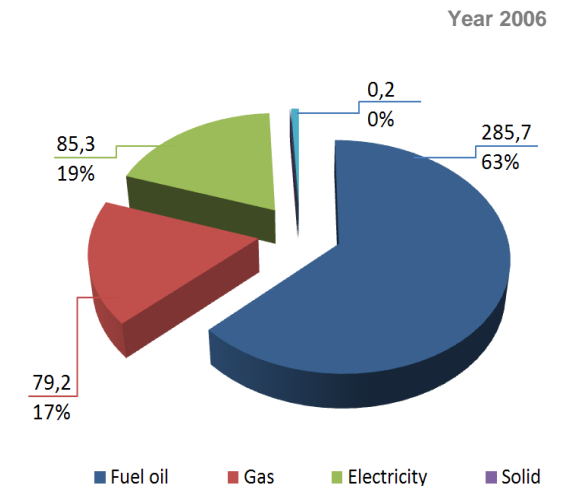
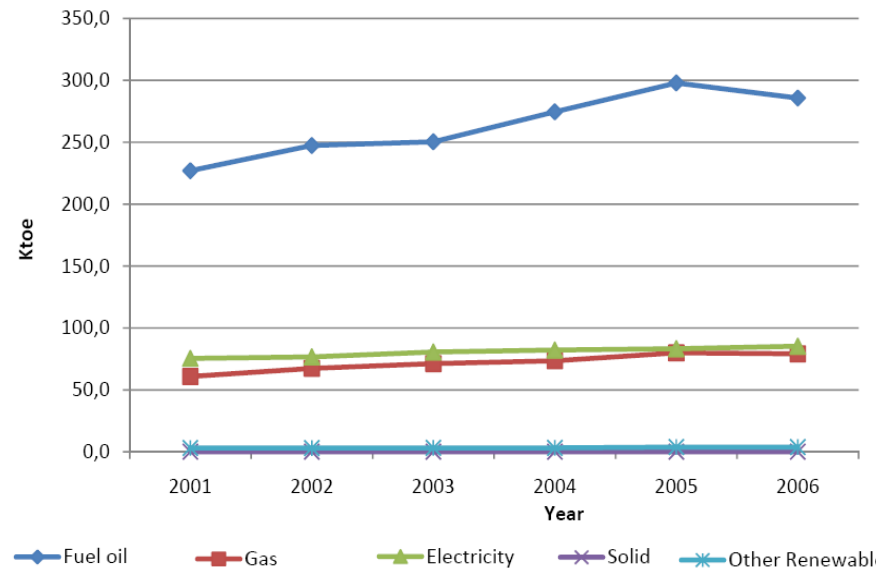


Table 06 – Usage of energy carriers for vector in the region.  
Source: BER 2001-2006



The first element that emerges in evident manner from the graph “Electricity balance” (with data updated to 2009) is that the Valle d’Aosta exports a great deal of electricity produced by renewable sources. On average, circa 60% of electricity produced annually (generated almost exclusively by hydroelectric plants) is destined for electricity requirements outside the regional territory. The Valle d’Aosta, in effect, makes available for the rest of Italy a large quantity of energy produced by renewable sources, which contributes to the reduction of global CO2 emissions (see CO2 emissions balance graph).

On the other hand, the Valle d’Aosta is completely dependent on the import of fossil fuels. In the graph “Energy self-sufficiency” (1990-2006) gross regional production and consumption are compared.

It is evident how the Valle d’Aosta, notwithstanding the high level of hydroelectric energy exported, is not self-sufficient in energy terms. The trend in recent years shows how the energy deficit is growing, that is faced with a slightly decreasing production consumption is ever increasing, the deficit is compensated by the ample import of most specifically fossil fuels. If in 1994 production was equal to circa 81% of consumption, in 2006 it represented only 52%.

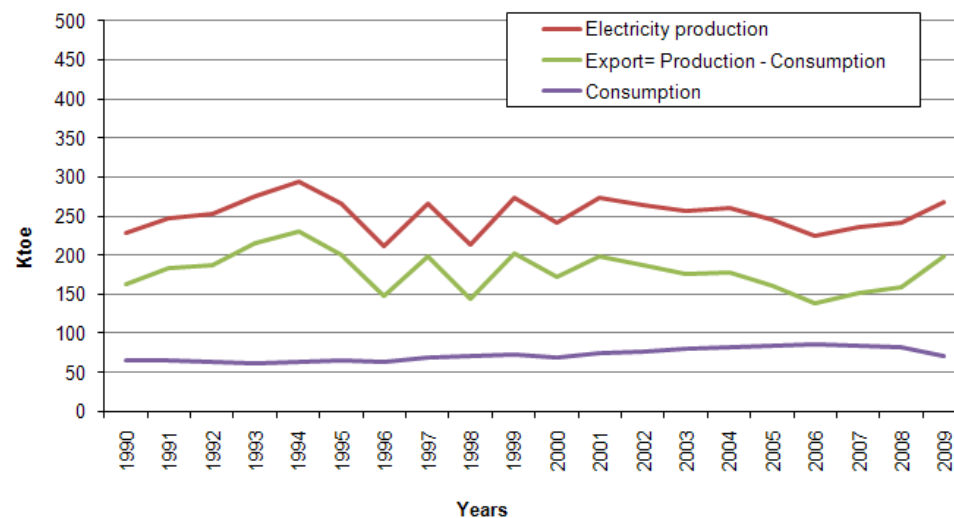


Table 07 – Electricity balance  
Source: BER 2001-2006

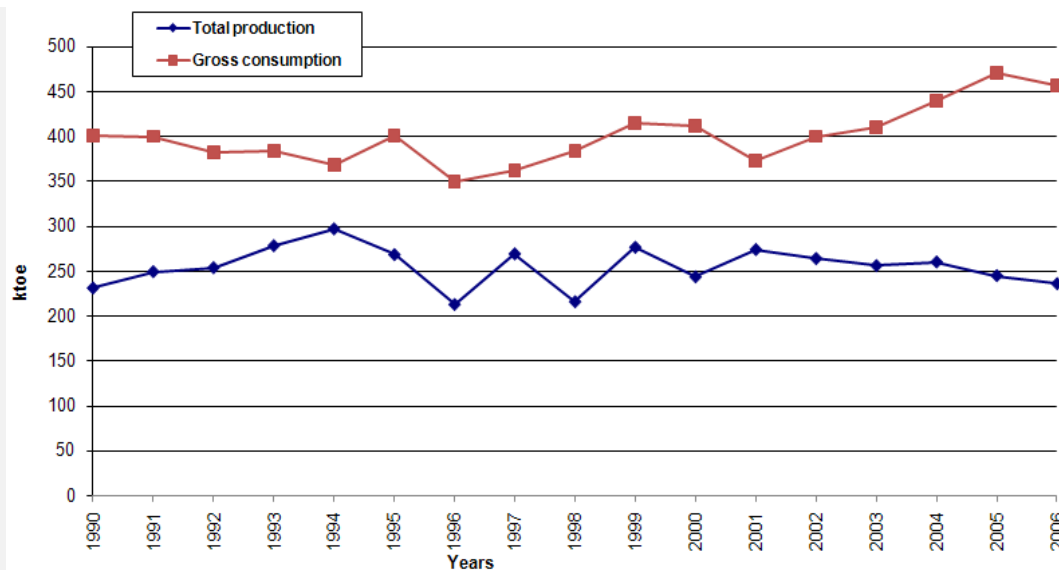


Table 08 – Energy self-sufficiency  
Source: BER 2001-2006

Comparing regional and national data shows that:

- consumption of oil-based fossil fuel, as a percentage, is greater in the Valle d'Aosta (42% in Valle d'Aosta compared to 18% nationally), as these sources are used in quite diffuse manner for domestic heating, as there are still ample areas (mainly mountainous areas) that are not connected to the methane distribution network;
- the consumption of gas fuels, as a percentage, (showing a great increase from 1990 to 2006) is lower (average 27% for the Valle d'Aosta compared to 46% nationally);
- in the Valle d'Aosta the civil sector represents the sector with the greatest energy demand, while the national data highlights a equilibrium between the civil and industrial sectors;
- electricity consumption settles at a greater value than the national average;
- energy consumption for transport is higher in the Valle d'Aosta taking into consideration the fact that the region is subject to heavy traffic flows for tourism and, as a border region, it is also subject to transit traffic.

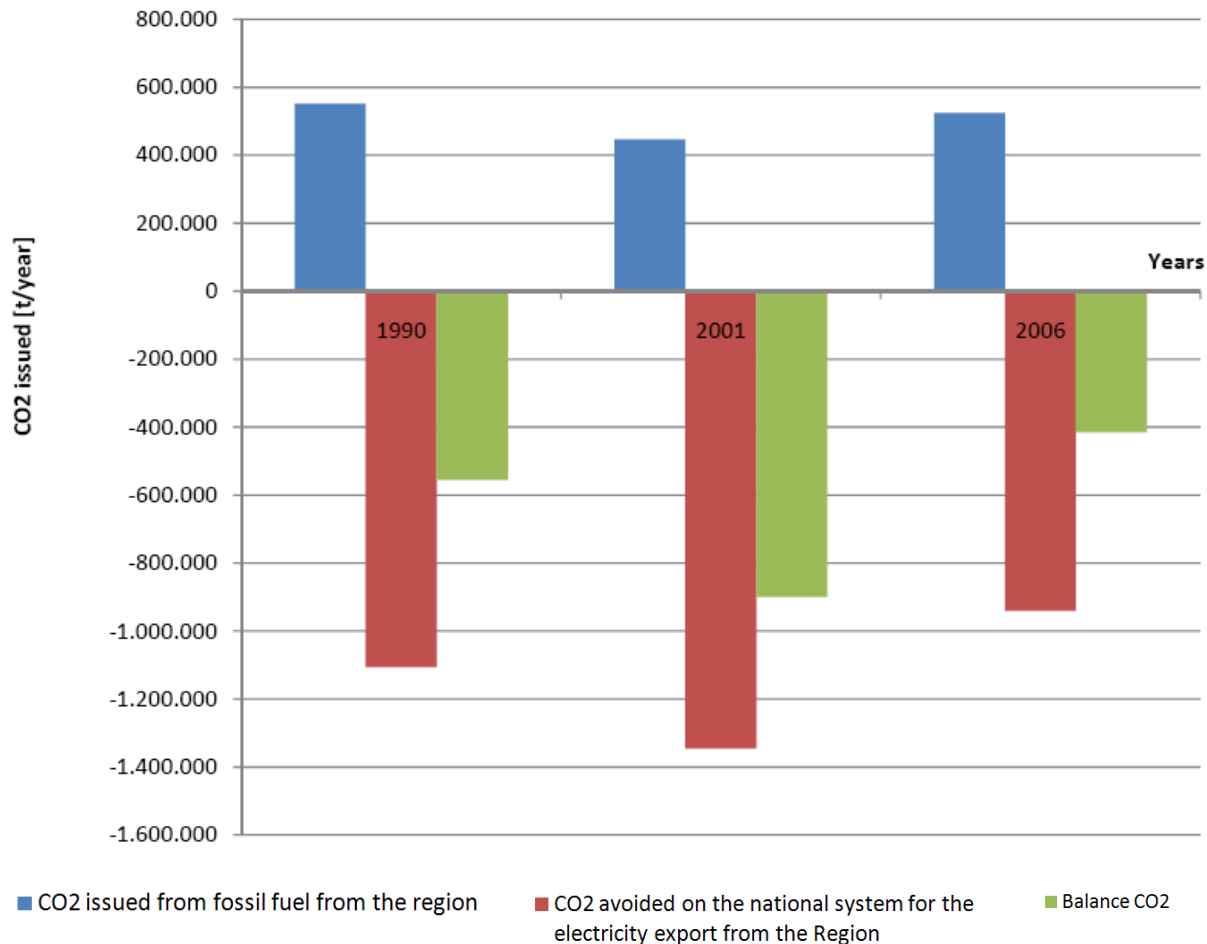


Table 09 – CO2 emissions balance  
Source: BER 2001-2006



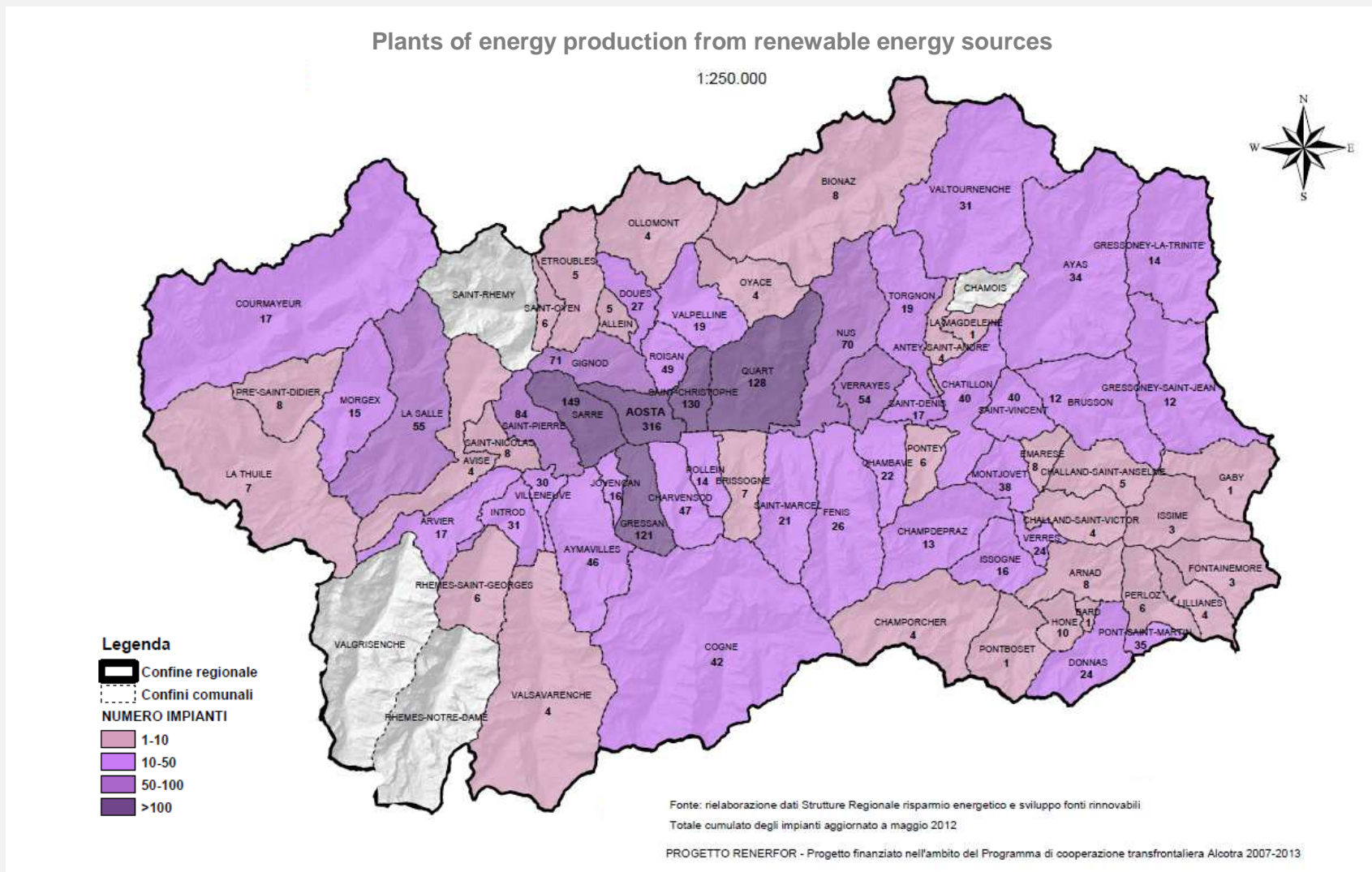


Figure 07 - Map of the solar thermal plants installed and financed by the Regional incentives law

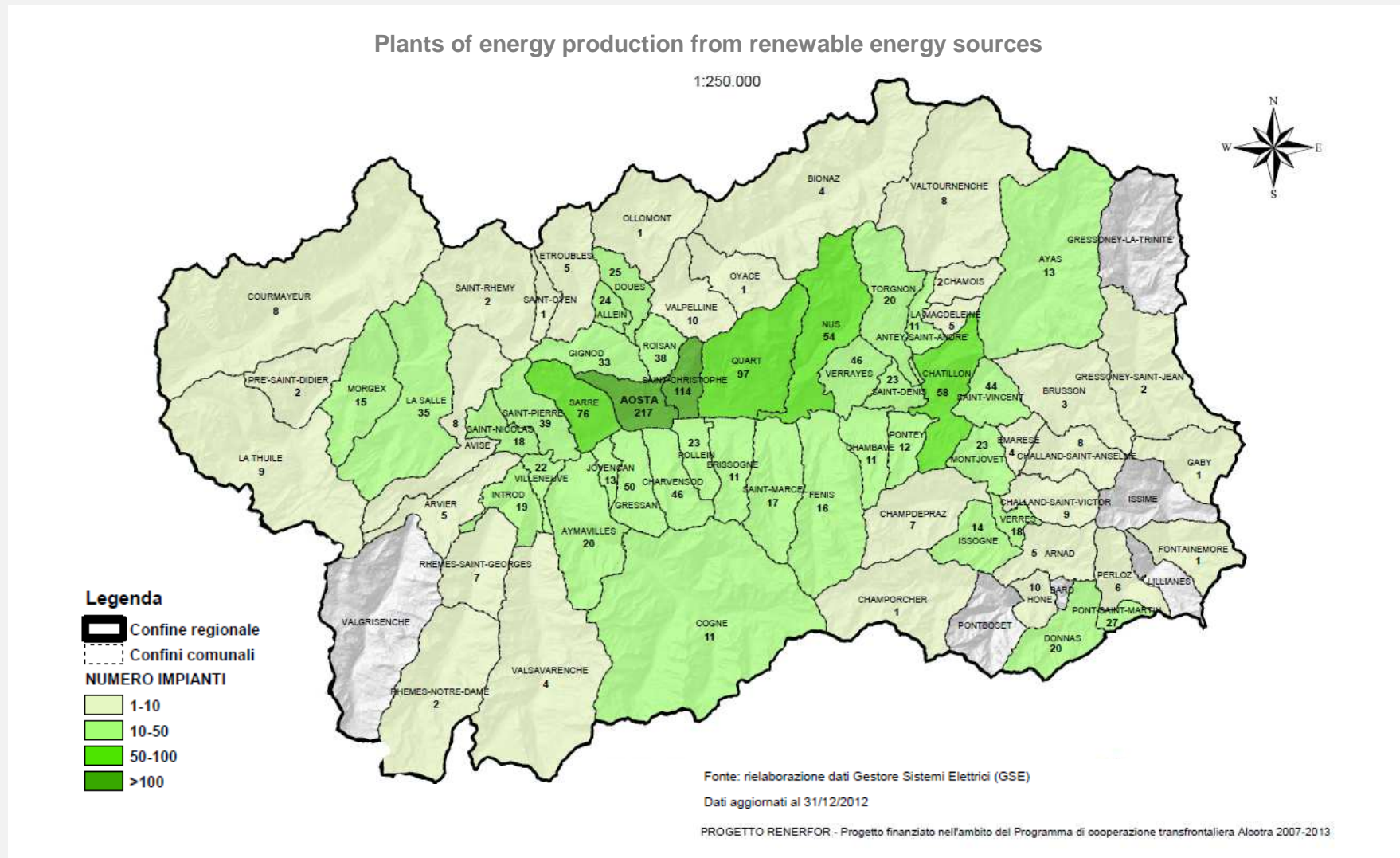


Figure 08 - Map of the solar PV plants installed on the Regional territory



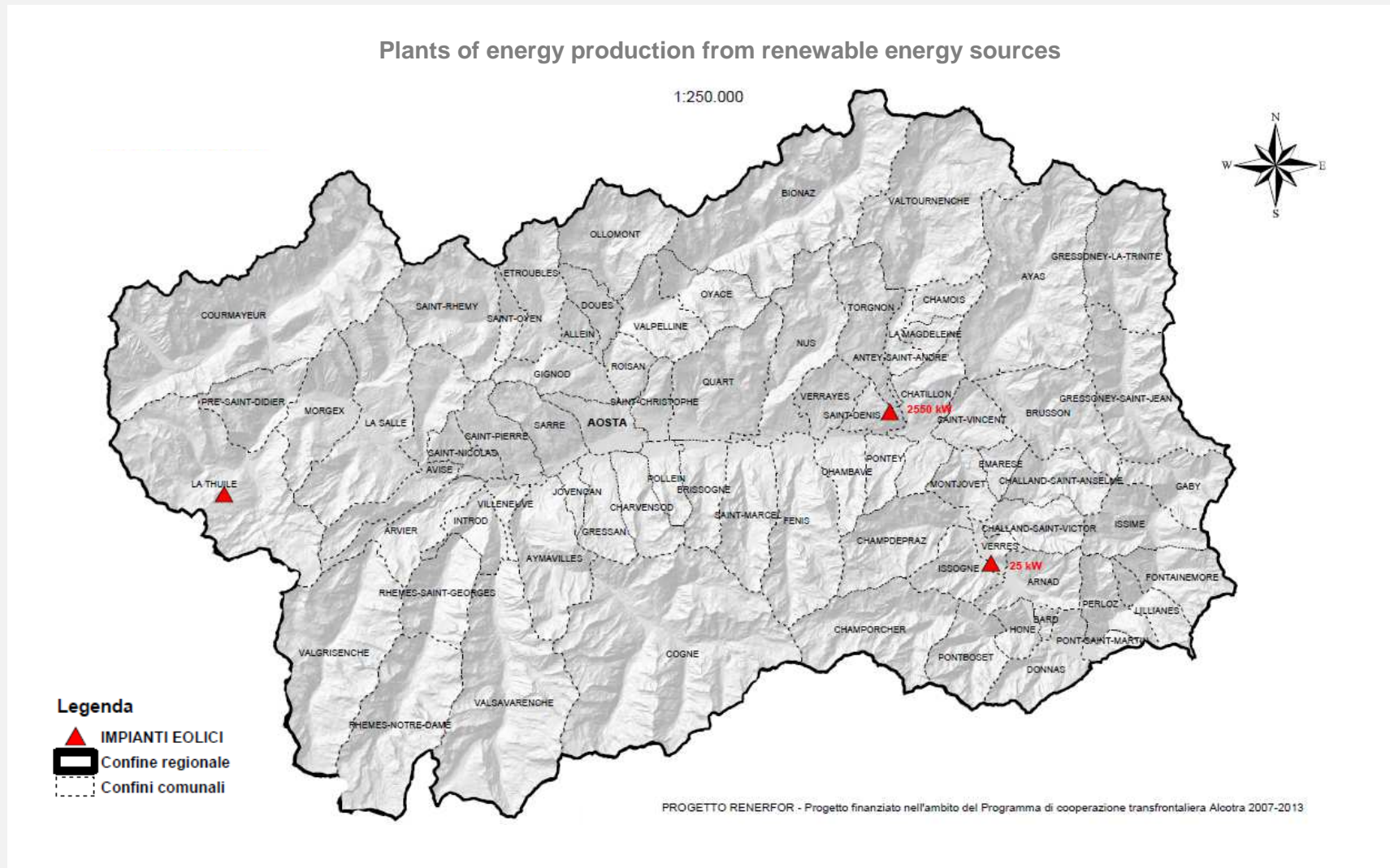


Figure 09 - Map of the eolic plants installed on the Regional territory

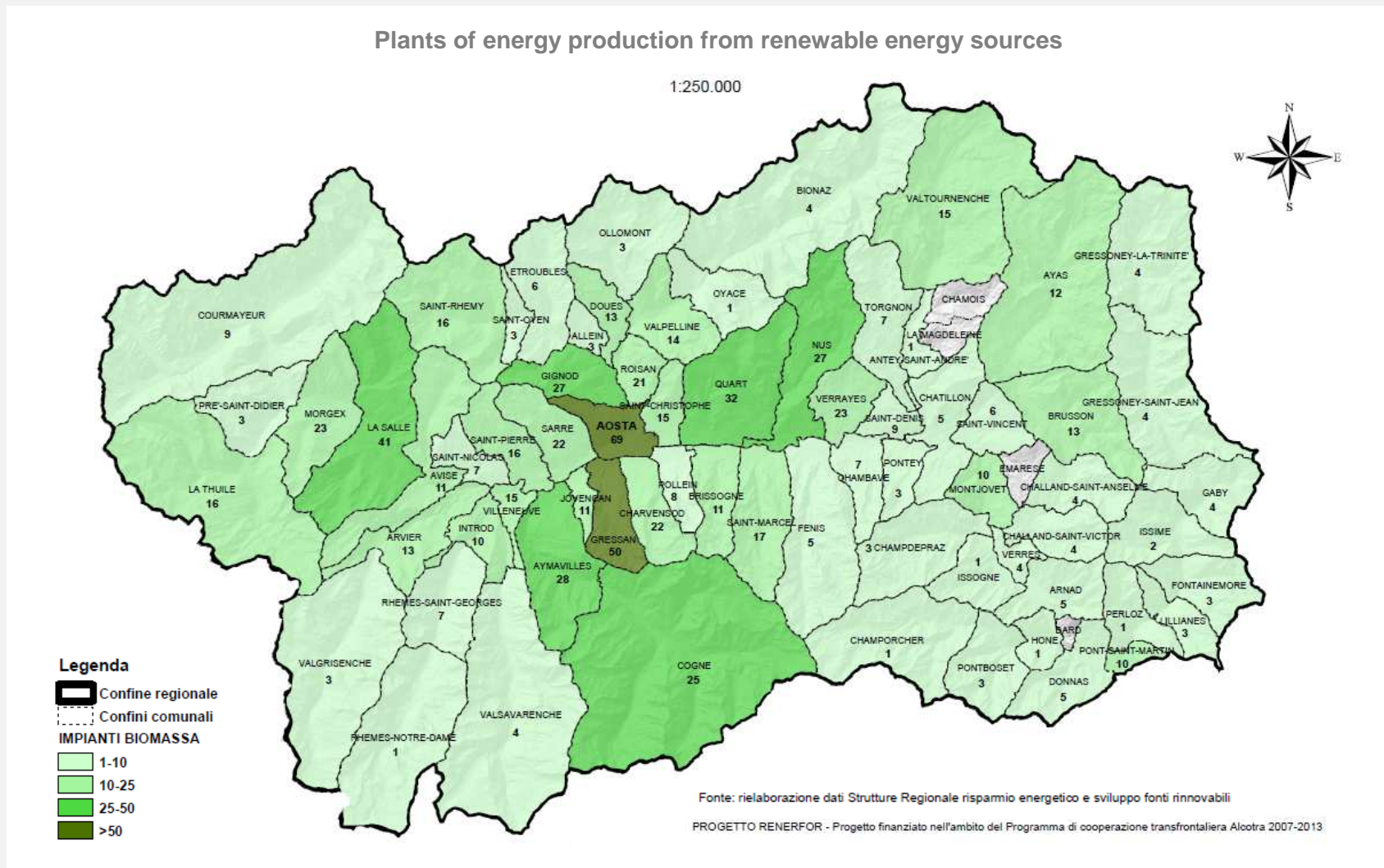


Figure 10 - Map of the biomass plants installed and financed by the Regional incentives law



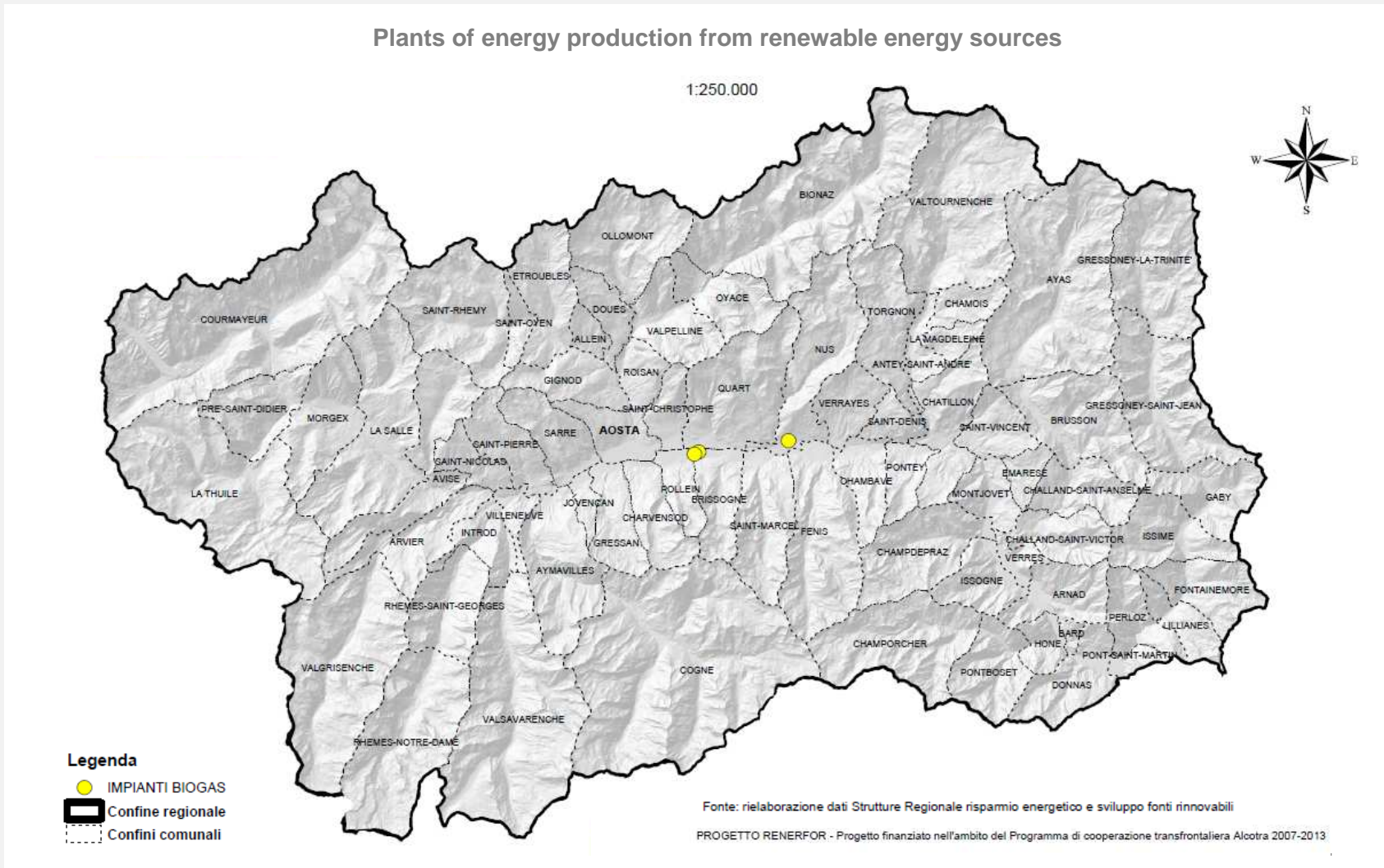


Figure 11 - Map of the biogas plants installed on the Regional territory

A.2.2 Regional specific analysis

**A.2.2.9 - Regional Building Culture**

In the Valle d'Aosta the traditional historical housing stock constitutes an important and diffuse reality within the territory.

Even if it is not possible to estimate the exact percentage of buildings belonging to the category of traditional historical buildings with respect to the total regional housing stock (the entire regional housing stock has not been completely recorded), it is appropriate to point out that this reality applies to more than 1200 settlements of various dimensions, origins and characteristics, of which 40% are situated above 1200 metres of altitude and 78% have less than 25 buildings.

The most recurrent types of rural Valle d'Aosta architecture are deeply bound:

- to the strong link architecture-context, both from the point of view of the materials used and by the shape of the building, as this is deeply constrained by the morphology of the location;
- to the forms of subsistence of the alpine communities, that determine both the development and the evolution of the building types as well as the conformation of the villages;
- to the cultural system of each local reality that brings with it traditional building practices that are consolidated within each single community;
- to the social relations within and between local communities;

From these aspects that characterise the relationship between man-alpine environment the four main models of buildings complementary to the traditional Valle d'Aosta architecture develop: the *maisons-tours*, the *ruraux en pierre à poteaux faitiers*, the *greniers*, the *racards* or *granges à blé* and the buildings with concentrated functions, that group under the same roof, all the activities related to man, to livestock and to agriculture. The evolution and transformation of existing settlements, reflected in processes tied to different factors (growth of families, improvement of economic conditions, etc.) are identified in the broadening or functional reorganisation of existing buildings, in their substitution or in the construction of new buildings. Often, these last two cases involve a variation of the original model, above all with regards to the materials, the architectural type and the representative architectural signs.

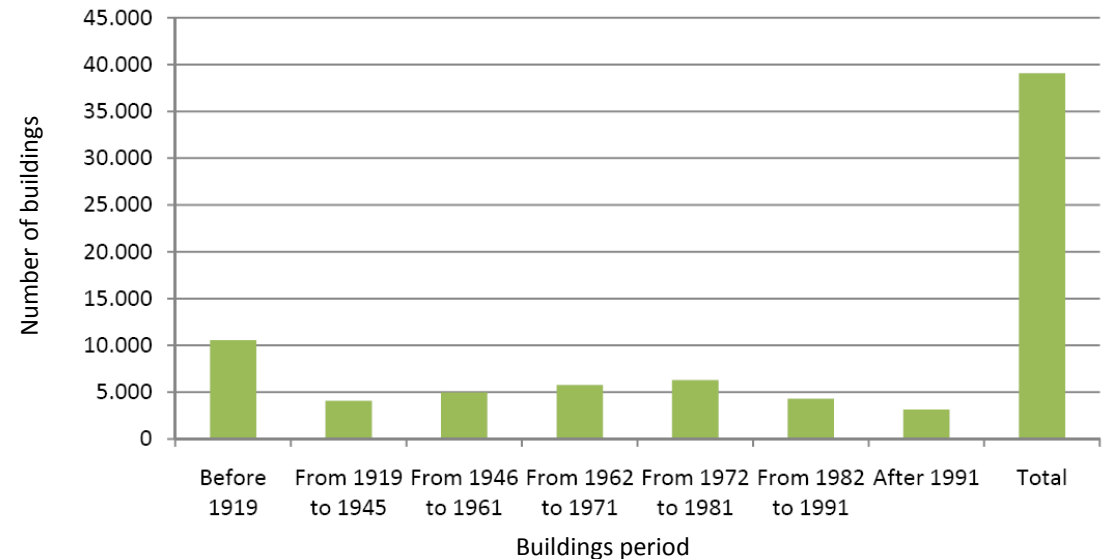


Table 02 – Number of buildings per building period in the region

Source: CENSUS 2001





The introduction of new models bound to the use of reinforced concrete and brickwork in the regional context highlighted in medium and small-sized urban developments determined deep transformations in the local reality: only in a few cases can the desire to recover traditional buildings through advanced technology.

The modern buildings are, generally, constituted by a load-bearing wall in reinforced concrete; often the external covering in exposed or plastered brickwork or in stone slabs highlight the structural cage of the frame. In some cases the rustic roofing in stone slabs contrasts with the geometric design of the exterior prospects; in other cases the flat roofing accentuates the rational character of the building.

Analysing the statistical data highlight how the building stock of the Valle d'Aosta is in continual growth. The most recent data (2001) shows that across the regional territory there are 50,734 buildings, of which 39,061 used as civil dwellings, equal to 77% of the total. The dwellings are in total 100,540, for a total of 7,169,862 m<sup>2</sup>: the municipality of Aosta has 15,690 dwellings, which amounts to 16% of the regional total.

The residential sector saw a growth of almost 50% from 1971 to 1981, of 14.2% in the following decade and of 10.7% from 1991-2001. The dwellings occupied by residents constituted, in 2001, slightly more than half of the dwellings present: the remaining quota is constituted by dwellings used as second homes or dwellings not normally occupied in a permanent manner, 100,540 dwellings are registered in a total of 39,061 buildings, that is circa 2,6 dwellings per building. This number, from a purely statistical point of view, shows how the prevalent building type in Valle d'Aosta is a single-family dwelling or a small complex of terraced houses.

A few municipalities, in particular Aosta, Gressoney-La-Trinité, La Thuile and Valtournenche, present a more concentrated building fabric, with an average of more than 4 dwellings per building.



Buildings material backbone

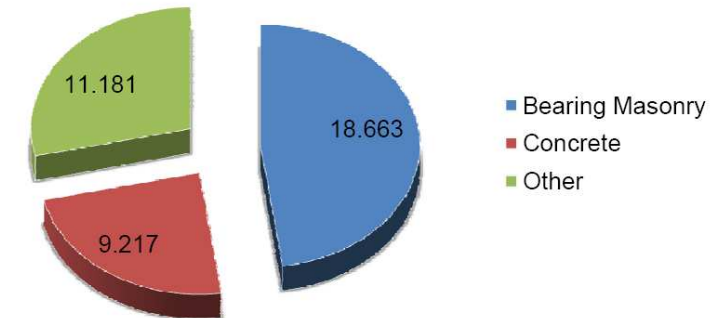


Table 03 – Residential buildings by type of material used for the backbone  
Source: CENSUS 2001

Residential buildings by number of property units

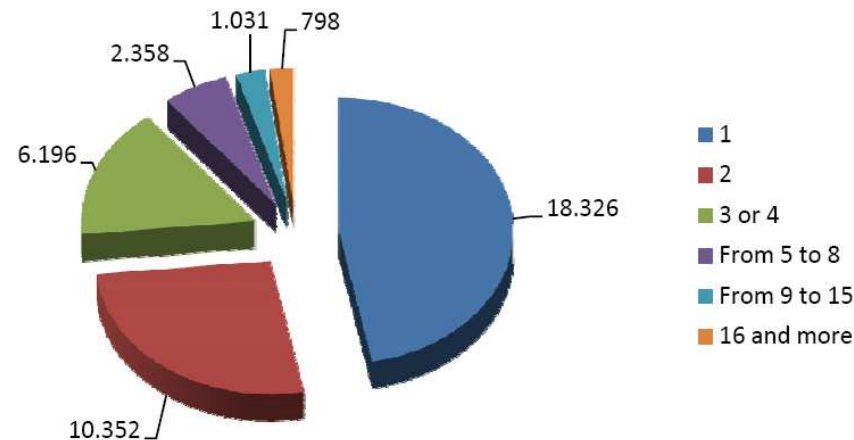


Table 04 – Residential buildings by number of property units  
Source: CENSUS 2001



## 1.4 Sources

### Literature

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